Strategy Research Project

COORDINATING GENERAL ENGINEER EFFORT IN STABILITY OPERATIONS

BY

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USAWC STRATEGY RESEARCH PROJECT

COORDINATING GENERAL ENGINEER EFFORT IN STABILITY OPERATIONS

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ABSTRACT

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Many entities are involved in general engineering during a contingency operation including the U.S. Army Corps of Engineers, host nation capabilities, civilian contractors and troop construction from all Services and allied nations. At the strategic and operational level the Engineer Coordinator (ENCOORD) function is accomplished by Theater Engineer Commands (TEC) and Engineer Brigade headquarters. U.S. military personnel will need to conduct general engineering missions to construct facilities for themselves and be prepared to improve the infrastructure of the local population. U.S. personnel may be tasked to restore essential services such as water, sewer and electric and develop roads and facilities to support economic development. There is currently no established process for ensuring staffs responsible for coordinating general engineer missions have the breadth of knowledge they need. Even though these soldiers have done exceptional work in support of current operations through dedication and perseverance, the ongoing nature of this requirement dictates better preparation of these unique units.

COORDINATING GENERAL ENGINEER SUPPORT IN STABILITY OPERATIONS

U.S. forces must operate across the entire spectrum of conflict from peacetime military engagements through major combat operations and face threats ranging from nation-states employing conventional or irregular warfare to non-state actors conducting insurgency or terrorist operations. Operations outside of the United States will fall into three categories: offensive, defensive and stability. These missions may be conducted sequentially or in parallel. Units will have to be trained and organized to conduct each of these operations and be prepared to move back and forth between them as the situation changes.[1] The Joint Operating Environment predicts U.S. forces will be continuously engaged in a combination of combat, security, engagement, and relief and reconstruction missions for at least the next twenty five years.[2]

Stability and Support operations may follow or precede major combat operations or even be conducted in one portion of a country while major combat operations are ongoing in another portion. They can be conducted either at the request of a partner nation which feels threatened or in a country where U.S. or coalition forces have just removed the existing regime.[3] The last few decades have shown that these missions will be long term and are likely to take part in less developed parts of the world. The fact that so many states are classified as failed or fragile implies U.S. forces are very likely to be called upon to execute stability operations in the near future.

During stability operations, U.S. personnel may be tasked to restore essential services such as water, sewer and electric and develop roads and facilities to support economic development. Field Manual 3.07, *Stability Operations* (FM 3.07) states military forces must be prepared to perform all tasks necessary to establish and

maintain order when civilian authorities are unable.[4] To be successful in these missions, U.S. military personnel will need to conduct general engineering missions to construct facilities for themselves and be prepared to improve the infrastructure of the local population. Projects for the local population may be executed in coordination with civilian agencies such as the U.S. Agency for International Development. In Iraq and Afghanistan the U.S. Army found itself involved in both restoring critical services and then assuming a substantial role in constructing long term economic infrastructure.[5]

Many different entities are involved in general engineering during a contingency operation including the U.S. Army Corps of Engineers (USACE), host nation capabilities, civilian contractors and troop construction from all Services and allied nations. At the strategic and operational level the Engineer Coordinator (ENCOORD) function at the joint force headquarters or combatant command is accomplished by Theater Engineer Commands (TEC) and Engineer Brigade (EN BDE) headquarters. The ENCOORD staff is responsible for translating broad operational design into a coherent, executable plan for employing the force.[6] These units may be assigned to a Corps, Joint Task Force or Army Service Component Command (ASCC) during contingency operations. With augmentation they may also be tasked as the joint engineer headquarters and serve as the senior engineer headquarters in a Joint Operational Area.[7]

An ASCC or Coalition/Joint Forces Land Component Command (C/JFLCC) may perform the ENCOORD function instead of an engineer headquarters. During multi-national operations, unique command structures will be developed which may result in U.S. forces being placed under the operational control of a foreign commander. Since

2010 many of the U.S. units have been under the operational control of the NATO International Joint Command (IJC) in Kabul which has established CJENG (Combined, Joint ENG) HQ.[8] In these instances, U.S. personnel to man these staff sections will likely come from the TEC or Engineer Brigade. While these headquarters are responsible for coordinating all engineer functions, they will likely spend a significant amount of their time on general engineering since combat engineering assets will be in direct support of maneuver unit operations. The ENCOORD staff must understand the unique capabilities of each of the organizations participating in the general engineering mission and how their efforts contribute to the whole.

In addition to designated engineer headquarters, specialized engineer units augment staffs at echelons above brigade combat team to improve their ability to control general engineering effort in their sectors. In a Joint task Force (JTF) headquarters, engineers may be in the operations, logistics or a separate staff section.[9] These include Engineer Facility Detachments (EFDs) and Forward Engineer Support Teams (FESTs). FESTs and EFDs are seven or fifteen soldier units respectively designed to increase general engineering capabilities at the strategic, operational levels or tactical levels. FESTs which are provided by Districts of the USACE also include civilians in their organization which will limit their employment relative to FESTs from the Army reserve which are composed entirely of soldiers. While both FESTs and EFDs will spend the majority of their time on base camps or other installations, they will periodically need to visit project sites.

There is currently no established process for ensuring staffs responsible for coordinating general engineer missions have the breadth of knowledge they need to be

effective. Even though these soldiers have done exceptional work in support of Operations Iraqi Freedom and Enduring Freedom through dedication and perseverance, the ongoing nature of this requirement dictates better preparation of these unique units. This study will make the case for the importance of significant general engineering expertise during stability operations and make recommendations for actions which will improve the capability of engineer headquarters and specialized engineer units to plan and execute general engineer missions. The existing doctrine for general engineering, organization of engineer headquarters and specialized units and current training will be examined. This study will include suggestions for improving this each of these factors.

Army Engineer Performance in Ongoing Conflicts

A 2008 Initial Impressions Report from the Army Center for Lessons Learned (CALL) noted that engineer units in Iraq were conducting missions they were not prepared to execute. This report stated the main issues associated with Army engineer support to stability operations included capacity building; construction material management, an integrated planning and construction common operating picture and developing Iraqi Army Engineer partnerships.[10] Army units executed these missions to the best of their abilities, but felt they would have been more effective if they had been better prepared.

In response to the CALL report the U.S. Army Training and Doctrine Command (TRADCOC) Analysis Center (TRAC) recently sponsored a study on the ability of EN BDE headquarters to provide effective command and control of assigned units during stability operations. This is a critical level of command as the EN BDE will be the major engineer headquarters in theater for many operations.[11] This study covered all

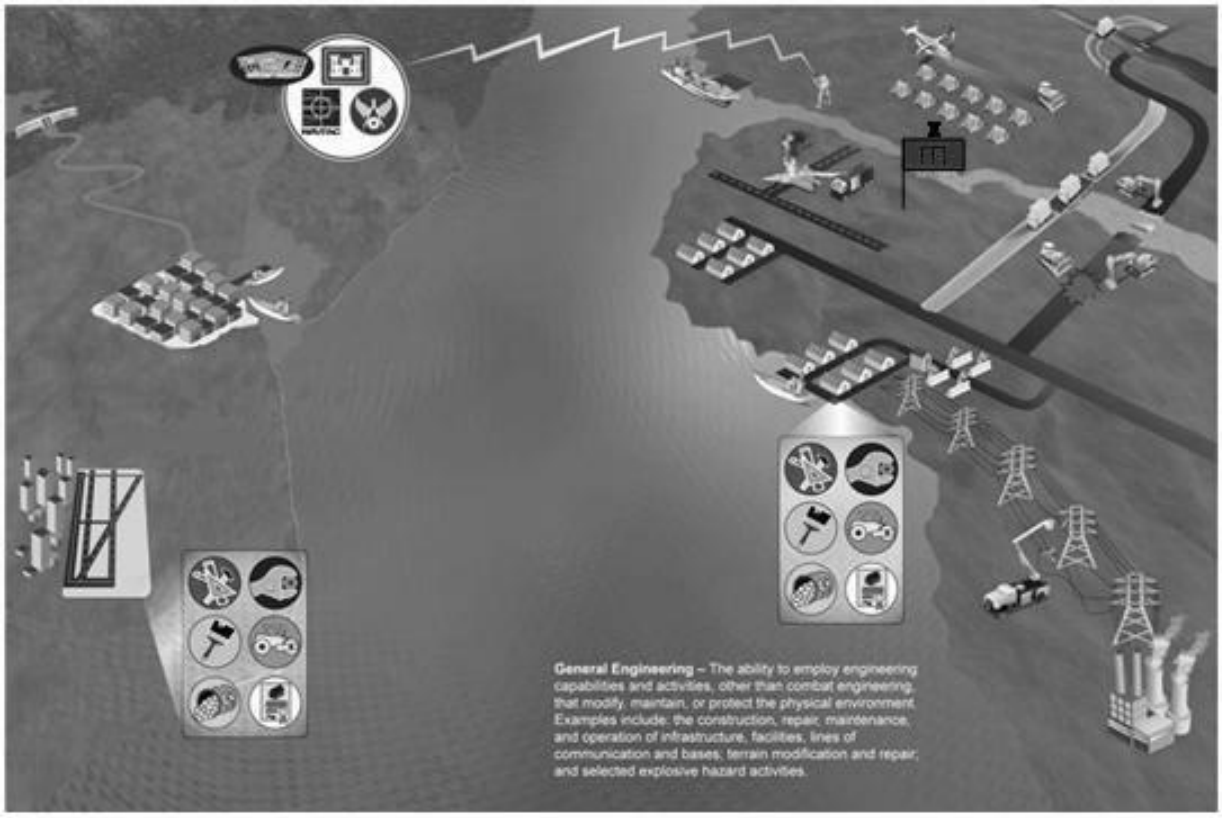
engineering functions including significant command and control issues involved when an EN BDE is required to manage and hold terrain which it may have to do during stability operations. The TRADOC study group identified five capability gaps in the general engineering function that were assessed as a high or extremely high risk to the operational force.[12]

Each of these capability gaps identified as high risk was assessed as having a doctrine, organization or training deficiency. This implies currently available soldiers and equipment could be better employed. By better utilizing existing resources and modifying training programs, EN BDE and TEC personnel will be better prepared for mission accomplishment during deployments.

General Engineering

The three main functions of the engineer force are combat engineering, geospatial engineering and general engineering. Field Manual 3-34.400, *General Engineering* (FM 3-34.400) lists typical engineering missions including construction and repairs of logistics facilities, lines of communication, airfields and helipads, ports, water sources, pipelines, power generation and distribution, base camp development, disposition of real estate and construction for the local country.[13] "General engineering is the most diverse of the three engineering functions and typically the largest percentage of all engineer support provided to an operation."[14] An operational view of the general engineering function is shown in Figure 1.[15] During the course of a contingency operation the facilities provided may grow from quickly erected temporary facilities to more permanent facilities that resemble those found on established installations in the U.S. Prioritizing available resources to execute these missions is

critical as there will seldom be enough capacity in military units or contracted support to accomplish all necessary construction and repair.



General Engineering Operational View

The Department of State has developed critical stability tasks necessary to support a secure peace, viable economy and legitimate host nation government. The U.S. military has translated these tasks into lines of effort in FM 3.07. They are Establish Civil Security, Establish Civil Control, Restore Essential Services, Support to Governance and Support to Economic and Infrastructure Development.[16] Engineer support is required for each of the lines of effort in stability operations and general engineering is a critical enabler for two of these lines; restore essential services and support to economic and infrastructure development. Because there will be so many requirements for construction, maintenance or repair of facilities and infrastructure, the

skill and efficiency of general engineering forces, augmented by civilian contractors and host nation assets, are a key part of establishing and maintaining stability. Prioritizing and apportioning this effort among available general engineering organizations is critical to their success.

The organization and training of the ENCOORD staff are critical components of their effectiveness. Organization includes the number, grade and skills of the personnel assigned to these units. The relatively small number of soldiers assigned to these staffs must accomplish a broad mission under circumstances that will vary widely from one region or command to the next. The mix of these personnel must support accomplishment of the specific mission of the unit and this can vary from one area of operation to another. The training of the personnel in these specialized units is crucial to their success. They must be able to accomplish very technical tasks as part of a team supporting the larger Joint Force mission. Doctrine should provide guidance for determining training priorities.

In addition to the complexity and variety of engineer missions, the composition of the current engineer force presents challenges as well. Since more than 75% of the total engineer force is in the Reserve Component, it is not surprising that engineer headquarters are predominantly in that component. The two TECs in the current force are both Army Reserve units.[17] Engineer Brigades may be either active duty, Army Reserve or Army National Guard although nine of the fourteen in the current force structure are in the Reserve Component.[18] All of the EFDs and the majority of the FESTs are also in the Army Reserve.

The personnel in these units typically gain much of their general engineering knowledge and experience from their civilian jobs. Reserve Component engineers are more likely to have engineering degrees and be certified as professional engineers than their active duty counterparts due to the requirements of their civilian careers. While this valuable experience has generally been gained at little cost to the Army, individuals and by extension units have rather uneven levels of knowledge and abilities.[19] Reserve Component units are more limited in their training time and assigned manning levels than their active duty counterparts prior to mobilization. These factors mandate their preparation must be as efficient and effective as possible.

ENCOORD Staff Doctrine

Doctrine should provide guidance on how units will accomplish their mission. Army field manuals contain only general direction on how general engineering should be conducted. Field Manual 3-34, *Engineer Operations* (FM 3-34) includes a significant list of missions that general engineering units should be able to perform. This manual also describes how general engineering differs from combat engineering and geospatial engineering, but then states these functions may overlap and units organized and equipped for one of these functions may be required to perform one of the other functions.[20] General engineering missions are discussed further in FM 3-34.400 and include:

- Construction and repair of logistics facilities
- Construction and repair of supply routes and lines of communication including bridges and roads
- Construction and repair of airfields and helipads

- Construction and repair of ports
- Construction and repair of water wells and sources
- Construction and repair of water and fuel lines
- Construction and repair of power generation and distribution
- Base camp development
- Acquisition and disposition of real estate
- Environmental considerations
- Construction for local country[21]

This manual includes useful points to consider, but there is not enough guidance or information to execute these missions without additional references or extensive experience. Separate manuals exist for some, but not all of these missions. There is also no guidance or process for prioritizing the missions which may reflect the recognition that each deployment will be unique. This lack of specific guidance makes it very difficult to prepare general engineering units to be successful during deployments.

At a September 2010 Commander's Conference, the Design Engineer and the ranking officers of the three EFDs assigned to the 411th En BDE were queried about general engineer missions performed during recent deployments. The Design Engineer is the ranking officer in the EN BDE Technical Headquarters, which is the staff element responsible for providing staff supervision of general engineering. These officers had been responsible for overseeing general engineering missions in Kosovo, Iraq, Afghanistan and Kuwait. The intent of this line of inquiry was to identify mission areas to focus on to best prepare engineer headquarters staff personnel for future deployments.

Appendix 1 describes these missions and the assessment of these four experienced Lieutenant Colonels as to how often these skills have been required lately.

The most common missions were the development of base camps and logistics facilities. These facilities will be required in all contingency operations since an expeditionary military will always need a base with operational support capabilities. Units assigned as garrison staff or mayor's cells at base camps are often unaware of the substantial requirements for developing and maintaining a master plan and will require engineer expertise. These units have typically lacked planning, engineering and contract management capabilities.[22] Construction of base camp facilities is never complete. Base camps and logistic facilities are constantly upgraded as the number, type and size of the units assigned to these installations change. During most stability operations logistics facilities will be located on a base camp because of security and efficiency considerations. The base camps are where the personnel who man the logistics facilities live and work primarily because of the availability of adequate utilities. There are therefore many similarities between these two missions. All units that may be tasked with coordinating general engineering should be familiar with base camp master planning including how installation design can affect force protection and mission accomplishment.

The CALL report described the lack of guidance on how to proceed on base camp planning, but chapter 11 and appendix E of FM 3-34.400 provides useful information for developing and maintaining a base camp master plan. The contents of this manual are a good source for deciding what features should be included in a given facility. While this guidance may be insufficient for non-engineer personnel assigned to

a base camp staff, ENCOORD personnel could use this reference to provide advice to a camp or garrison commander on how to arrange their facility and prioritize construction and maintenance effort. This general advice will need to be supplemented with specific considerations for a particular theater based on local conditions.

Another mission conducted frequently by recently deployed units was road construction. Much of the road construction was on or leading to a base camp. These roads are critical for promoting ease of movement for personnel and supplies needed for the operation of these facilities. Roads will require maintenance and repair due to use and may require widening or other improvements as operations progress. Only one of the recently deployed EFDs had significant experience with bridging. Due to the criticality of bridges as part of supply routes and other lines of communication, this mission needs to continue to be stressed. An area of special emphasis which should be included in the training for ENCOORD staffs should be expedient repairs on damaged bridges. Efforts to establish and improve lines of communication to support military operations can also have a beneficial impact on the local population since transportation infrastructure can accommodate both military and civilian uses.[23]

The next most common missions, airfield and helipad construction and power generation and distribution were executed on a base camp. All major installations will need to include or have an airfield nearby for operational and sustainment requirements. For some operations, such as the campaign to stop ethnic violence in Kosovo in 1999, the capacity of airfields is critical to the success of the mission. The limited facilities at Rinas airport in Albania severely hampered the deployment of the

U.S. Army's Task Force Hawk.[24] Even the smallest outpost will need a helipad for medical evacuation purposes.

Electrical power is necessary to support mission requirements such as communication as well as for basic life support. Multiple individual generators will typically be used during initial facility development. Engineers must understand how to integrate generators into power grids and eventually transition to prime power. Training on the development of base camps should include considerations for aviation support as well as utilities with a focus on electric power.

None of the personnel deployed recently on ENCOORD staffs had any significant experience with ports. This probably reflects the tendency to use commercial ports in friendly countries like Kuwait, Qatar and Pakistan to support operations in Iraq and Afghanistan. If U.S. forces are required to develop or expand a port in future operations, they will need augmentation from USACE or Navy Facilities Engineering Command expertise. TEC personnel should review existing Combatant Command Contingency plans to determine if U.S. forces are likely to be required to execute this mission.

Units from the 411th Engineer Brigade had minimal experience with construction for the host nation even though provision of essential services is considered a critical component in building support for a local government.[25] The vast majority of general engineering effort conducted by these units was for U.S. and coalition personnel. Basic construction principles will be similar no matter who the user of a completed facility will be, but local customs can drive changes in design or building material.

The CALL study also identified stability engineer missions not covered in existing field manuals. Army engineers in theater have been tasked with educating Iraqi engineers to make them more capable and training local personnel in construction skills to make them employable. None of the personnel in the units currently assigned or attached to the 411th En BDE had any experience with this mission although individuals filling billets with the Gulf Regions Division had experience with Iraqis trained in quality control by the USACE. The CALL document states this mission has been assigned to the Engineer Brigade or Battalion level.[26] Engineer headquarters should therefore consider how existing training programs should be modified to enhance the engineer capacity of local nationals.

The TRAC EN BDE study indicated that an extremely high risk capability gap was the ability to establish and operate a construction material management site. Construction material is taking 270 days to arrive in theater from the time the request is submitted. This makes it extremely difficult for a unit to plan and execute a project within a one year deployment period. Study participants and the CALL report noted that the volume and variety of required construction material is placing a strain on the existing logistics system. CALL study participants determined this issue was so important and involved so many stakeholders that a separate Integrated Capabilities Development Team (ICDT) was needed to address this issue.[27] Engineer staffs must be aware that this is an area that will require significant coordination and oversight and will necessitate a well thought handover process when staff members are rotated out and new personnel assume the mission.

Current doctrine is also vague on who will coordinate the general engineering mission and where they will be located. FM 3-34 states general engineering occurs throughout the area of operations, at all levels of war and may need to be coordinated by any headquarters from brigade through theater army or Joint Task Force. Since 2003 it has become apparent that tactical headquarters do not have ability to manage large construction projects.[28] Because there are only 14 EN BDE headquarters in the force structure, these headquarters will not be available for every deployed division, corps or JTF. To meet this need the Army has developed specialized units throughout the Engineer Regiment. Since many of these units are in the Reserve Component or Army Corps of Engineers, tactical or operational headquarters may not have adequate knowledge of the capabilities of these units. These units may also be assigned to theater level headquarters tasked with developing support facilities for joint and coalition forces conducting an operation.

As individuals or in small teams, specialized engineer units must integrate into a larger active duty Army organization while becoming familiar with unique aspects affecting general engineering in that theater.[29] These personnel must be able to understand and leverage the capabilities of all available engineering assets in order to accomplish the mission of their parent organization. There is currently no established process for providing ENCOORD staffs with the wide knowledge they need to be effective. The primary method for learning the capabilities and limitations of the entities providing general engineering is through on the job training.

ENCORD Staff Organization

ENCOORD staffs assist the commander in controlling all engineer operations in their area of operations. This includes organic, assigned or attached units as well as other organizations operating in the area. Accomplishment of this mission requires personnel skilled in the technical aspects of project management as well as surveying, automated drafting and quality assurance. While engineers are organic to the staff of all echelons above Brigade, the significant requirements of this mission often require augmentation. The authorized strength of Army units which may be assigned the ENCOORD mission during stability operations is shown in Figure 1.

Unit	Project Design/ Project Management	Drafting	Surveying	Quality Assurance	Contract Management and Purchasing
EN BDE Technical HQ	1 Field Grade Officer, 3 Company Grade Officers, 1 Warrant Officer	6 Enlisted Soldiers	6 Enlisted Soldiers	6 Enlisted Soldiers	2 Field Grade Officers, 1 NCO
EFD	5 Field Grade and 5 Company Grade Officers	*	0	5 Non Commissioned Officers	*
FEST-A	1 Field Grade and 4 Company Grade Officers	*	0		*
* - While no members of the EFD or FEST-A are assigned to this function, the unit will need to dedicate somebody to do these tasks					

Figure 1: ENCOORD Organizations

This table does not include the TEC headquarters. Doctrinally the TEC is the only organization designed for operational command of engineer capabilities without augmentation. [30] The entire TEC will only mobilize in support of major combat operations and not for stability operations. Recently the TEC has provided personnel to

augment the USACE District in theater instead of controlling engineer brigades assigned to Corps and Divisions. The TEC uses a Deployable Command Post (DCP) as opposed to sending the entire HQ to accomplish this mission. The DCP works closely with the USACE and the U.S. Agency for International Development to develop priorities and policies to guide engineer operations and determine assets required to achieve the commander's objectives. The DCP for a TEC is designed to be a 59 person organization headed by a brigadier general.[31] During recent deployments, the size and composition of this unit has varied based on the requirements of a particular mission. A DCP recently formed by the 412th TEC had 39 personnel, 33 of which were senior officers and NCOs.[32] The majority of the personnel in the DCP are concerned primarily with coordinating general engineering. In recent years the TEC has had to pull significant numbers of these personnel from subordinate units.

The technical HQ staff of a standard engineer brigade is authorized 25 personnel including five officers, one warrant officer and nineteen enlisted soldiers. This organization allows for adequate drafting capability, survey teams and a quality assurance squad. There is also a section tasked with purchasing necessary equipment and materials and overseeing contracts with local construction firms. These individuals are not contracting officers; they are responsible for certifying that contracted firms have fulfilled the technical requirements of their contract. Other members of the technical headquarters assist them in this Contracting Officer's Representative function. There are only three officers and one warrant officer assigned for design and project management. This does not provide much technical expertise for master planning or developing scopes of work for assigned and attached units. This is especially true

when the brigade must form a deployable command post operating away from the main headquarters which it is doctrinally required to be able to do. The technical headquarters cannot expect much assistance from the rest of the EN BDE staff as a significant portion of their attention will be dedicated to combat operations such as controlling route clearance operations.[33]

Compounding the problem is the consideration that the BDE staff may be required to augment the engineering capacity of tactical headquarters. During a recent deployment the 411th Engineer Brigade had to augment the engineering capacity of a division headquarters staff. This required the Brigade to send three officers and three NCOs to plan and manage general engineering in the division sector. The BDE HQ was augmented by personnel from higher and lower echelons to complete this mission.[34] The capacities of three other staffs were therefore reduced in order to augment one tactical headquarters.

When the 20th Engineer Brigade deployed to Iraq in 2007, they integrated the 673rd Facility Engineer Detachment into their staff and had them perform the technical headquarters function.[35] This organization is currently referred to as an EFD. This was necessary because the Engineer Brigade assigned to the XVIIIth Airborne Corps is not as robust as a standard Engineer Brigade. EFDs are intended to augment headquarters elements and provide master planning, construction management and contract technical oversight capability. The ten officers assigned to this unit provided significant technical depth; however the lack of technical engineering specialists resulted in limited drafting and quality assurance capability and no organic surveyors.

There are no personnel designated to perform drafting or budget and contract oversight, but units have had to dedicate personnel to this mission during past deployments.

The FEST-A has essentially half the personnel of an EFD with a similar mix of officers and enlisted. It has many of the same capabilities and limitations as an EFD, but has only one field grade officer and no Master Sergeant. This means assigned personnel are not as experienced as EFD personnel. Also having to dedicate personnel to drafting and budget and contract oversight presents more of an issue when there are fewer personnel to draw from. A FEST-A will typically be deployed to augment the engineering staff of a larger organization such as an Area Support Group, Division, Corps or joint force headquarters.

None of these organizations appears to have the necessary number or mix of personnel to perform the ENCOORD mission without some augmentation. The Brigade Technical Headquarters has few officers while EFD and FEST do not include organic drafters or surveyors and have limited quality assurance personnel. These limitations are especially problematic when general engineer missions are executed over a large area or in a hostile area making it difficult for a small number of personnel to cover multiple projects.

A better organization would be to add additional engineer officers to the brigade technical headquarters staff. This would provide additional technical depth which would be useful in coordinating numerous projects. The recent attachment of EFDs and FEST-As to Army Reserve EN BDEs provides a source for these additional personnel. These units should develop habitual training relationships with EN BDE and could provide personnel to the headquarters during training prior to deployment. The fact that

these units currently exist provides a ready answer for enhancing the general engineering capability of the EN BDE HQ, however using them whenever an EN BDE is mobilized may significantly increase their deployment schedule or reduce their availability to support other headquarters. This could result in the EN BDE assuming even more responsibility for exercising control over general engineering in theater. During stability operations the EN BDE HQ should be tailored with personnel from an EFD or FEST when the brigade is the primary engineer headquarters in theater.[36]

ENCOORD Staff Training

To be effective, ENCOORD staffs need to understand the capabilities and limitations of the wide variety of organizations which may be assigned general engineering missions during stability operations. Engineer assets may come from any of the Services, host nation or coalition militaries and civilian construction firms.

One of the best ways to learn about the capabilities and limitations of other Services would be to conduct joint training events. Current Army Reserve general engineering training exercises involve only other Army Reserve units. For instance, the units participating in the Castle Installation Related Construction (IRC) exercise scheduled for July 2011 at Fort Dix, NJ are two Army Reserve engineer battalions and other Army Reserve Detachments under the direction of an Army Reserve EN BDE HQ.[37] IRC exercises are designed to provide training for engineer units while improving the training facilities on an installation that will be used as a mobilization site for reserve units. This exercise will be planned and controlled by 411th EN BDE personnel who would be expected to perform the ENCOORD mission during deployment, but the units participating in the exercise limit the training value for the headquarters. Adding active

duty Army, Navy or Air Force general or combat engineering units to these exercises would improve interoperability and enhance staff training. It would also help prepare a variety of units for the types of missions they may be assigned during deployments. Given the long duration and the large number of engineering missions involved in stability missions, combat engineer units may be assigned general engineering missions.

While exercises help general engineering units become more proficient in troop construction tasks, they do little to enhance interaction with civilian contractors or develop the ability to administer contracts. They also do not provide much opportunity to practice construction methods more durable than theater construction. A method for addressing these deficiencies is through partnering with the Directorate for Public Works (DPW) at a local installation. Reserve Component engineers can develop scopes of work and develop time, cost and material estimates on projects which the DPW has not had the resources to address. This will provide valuable experience for the engineers while assisting the DPW with their project backload. Working with DPW personnel on a regular basis provides experience with developing and overseeing contracts with civilian construction firms. Because they are located on all installations, most reserve units will be able to find a DPW in their local area. The technical headquarters, EFDs and FEST-As assigned to the 411th Engineer Brigade are currently developing these mutually beneficial relations with local DPWs.

Missions such as Castle IRC usually do not involve technically complex missions since the intent is to have troop construction units complete them during a few weeks of annual training. Therefore the technical capabilities of the Engineer Brigade Technical

HQ or assigned EFDs or FEST-As are not exercised. Because EFDs and FESTs are typically not collocated with other EN BDE units and have no full time personnel, it is difficult for them to schedule training events. This makes it vital that they obtain the maximum possible benefit from exercises they participate in. A method for getting more training benefit is to have these units contact the host installation DPW and identify other projects, which were not part of the exercise; they can work on while on site for the exercise. This has worked well for the EFDs assigned to the 411th EN BDE in recent years providing benefits to the unit and the installation.

All large construction projects on military installations are executed by the USACE so personnel working with the DPW will also gain experience with USACE. Individuals from TECs, EN BDE HQs, EFDs and Army Reserve FEST-As could be assigned to work with USACE district offices. This would provide additional insight into their method of doing business, especially regarding contract administration. These personnel could also provide USACE personnel, many of whom are civilian, a perspective on the capabilities of reserve organizations. The USACE division would also likely appreciate having additional skilled personnel available to assist with their ongoing projects. Through its Field Force Engineering initiative the USACE has established reachback capabilities to make the technical expertise of personnel at district and divisions as well as USACE labs readily available to Army engineers in the field.[38] The relationships developed during training prior to deployment would enhance the effectiveness of this capability.

More relevant experience could be gained from interactions with the Middle East District of USACE which is the U.S. based office responsible for engineering and

construction support to Central Command. Personnel within the TECs and the technical headquarters sections of Engineer Brigades who are most likely to be on the ENCOORD staff should develop ongoing relationships with this organization. These relationships would provide more knowledge about how the USACE operates during contingency operations and gain their insight on projects being pursued in the near future.

Another way to gain additional technical experience would be to assign Reserve Component personnel to work with civilian architectural and engineering or construction firms. This would be especially useful for companies engaged in specialized projects such as bridge construction or renovation. To avoid legal issues involved with directly working for civilian firms, engineer staffs could work with local city or state governments executing infrastructure projects. The 1st Cavalry Division used this method to prepare for their deployment to Iraq in 2004.[39] In addition to the obvious benefits of gaining additional technical knowledge, the reserve soldiers would better understand how a firm given a scope of work in a contract would develop detailed plans and then decide the personnel and equipment necessary to execute those plans. This would provide useful experience that would help them produce better scopes of work in the future.

While it is unrealistic to assume that ENCOORD staff members could be expert on all of the missions listed in FM 3-34.400, there are items that will be common to all projects. Developing competence with scopes of work, time and cost estimating, surveying, project management and quality assurance will be useful for any construction project encountered. These skills should be practiced on a regular basis. This is a

good way to allow more junior members of the staff to make meaningful contributions to mission accomplishment.

Looking for commonalities in tasks can also be helpful. For instance whether designing airfield runways or roads, engineers will need to consider base courses, wearing surfaces and drainage. Both base camps and logistics facilities will require assessment of the best methods of building construction to balance necessary structural features of the facility with cost, time to complete and service life. Knowledge in these areas will be useful for a wide variety of future stability operations.

Conclusion

General engineering is a vital part of all expeditionary missions and is especially important in successful accomplishment of stability operations. Efficient execution of general engineering requires centralized control of available resources to set priorities and allocate scarce resources. Staff elements controlling this effort must have a thorough knowledge of the requirements of the mission and the capabilities and limitations of the units and organizations that will execute it. Personnel manning these staff elements come largely from the Reserve Component and must effectively use limited training time and leverage skills developed through civilian employment. Engineer doctrine should provide better guidance on which missions to prioritize during preparation for deployment. Personnel from EFDs and FESTs should be integrated into Engineer Brigade Technical Headquarters during deployment to sufficient technical depth to properly man DCPs and still control general engineering in the Brigade sector. Engineer headquarters personnel should routinely train with units from other Services and components as well as DPW, USACE and local government engineers.

Incorporating the changes recommended in this paper will increase the efficiency and effectiveness of the general engineering mission to better support the joint force commander.

Appendix A: General Engineering Experience of Recently Deployed Units		
Mission	Description	Recent Experience
Construction and repairs of logistics facilities	Design, plan, construct, upgrade, repair, and maintain facilities as simple as a hardstand or as complex as a small industrial park. Logistics installations include general, ammunition, and maintenance depots; storage sites (to include fuel storage); and hospitals.	All deployed units had some involvement with this mission. Planned and oversaw construction for logistics facilities including warehouses when theater base moved. FET 28 at Bagram built PLL storage field with Korean and Thai engineers.
Supply routes and lines of communication including bridges and roads	Design, plan, construct, upgrade, repair, and maintain roads, railroads and bridges. May not be constructed to same standards as civilian roads. Bridges can be over wet or dry gaps. Combat roads and trails are part of combat engineering.	All deployed units were involved with this mission. Primarily involved with roads on FOB and roads leading to FOB including ECPs. Mostly dirt and gravel, some asphalt. Work performed by contractors and troop construction. Only the 673rd FED as part of the 20th Engineer Brigade was very involved with bridges. No experience with railroads.
Airfields and helipads	Design, plan, construct, upgrade, repair, and maintain airfields and heliports. Army engineers are often responsible for initial airfield damage repair (ADR).	Three of four deployed units were involved with this mission. Worked with troop construction (Army and Air Force) and contractors to build, improve and repair airfields and helipads. Included expanding runways, adding hangars and tie downs.

Ports	Port construction and rehabilitation and coordinating with any Navy units engaged in harbor clearance and salvage operations, such as the neutralization of mines and underwater obstacles. Includes dredging as well as construction of necessary roads, railroads, storage facilities and utilities.	Only the 673rd FED as part of the 20th Engineer Brigade had any involvement with this mission. Designed boat ramp and assessed an existing jetty.
Water wells and sources	Drilling wells, construct improvised dams, construct pads for water purification and storage units.	Two of four deployed units had involvement with this mission. One team contracted for local personnel to dig wells. Another supported operation of a water plant.
Water and fuel lines	Maintenance and repair of existing pipelines. Design, construct, and expand the tactical pipeline system (including marine terminals and storage facilities).	Only FET 28 deployed to Bagram AFB had any involvement with this mission. Worked with troop construction to complete.
Power generation and distribution	Operation and maintenance or upgrade of existing utilities as well as the construction, operation, and maintenance of new utilities systems. Electrical power systems range from simple, unit-owned and maintained tactical generators to highly sophisticated multinational utility grids.	Three of four deployed units had involvement with this mission. Recommended sizing of generators for individual or small groups of buildings. Developed standards and procedures for safe wiring within facilities and grounding. Worked with Army Prime power units and contractors to develop grids.

Base Camp Development	Design, plan, construct, upgrade, repair, and maintain an evolving military facility supporting the operations of a deployed unit and provides the necessary support and services for sustained operations. Consists of a grouping of facilities within close proximity to each other, for the purpose of supporting an assigned tactical, operational, or logistical mission.	All deployed units were involved with this mission. Everything from laying out new camps to modifying camps that have been in operation for years. Tasks include master planning; developing project packets with scopes of work and estimates. Facilities included buildings for multiple purposes, utilities and interior roads as well as force protection.
Acquisition and disposition of Real Estate	Acquisition of real estate for use as office space, billeting and housing, mess, material storage, staging areas, maintenance functions, training, ports, roads, buffer or safety zones, etc. These facilities may be used to house operations, planning, administrative, logistics, maintenance, and other functions.	Only FET 24 reported any involvement with this mission. Determined additional land needed for expanding two basecamps and turned over land from a closed base camp to the Kuwait government.
Environmental considerations	Determine the impact of operations on the environment. Develop plans to minimize the release of hazardous substances into the environment, protect cultural and natural resources, and prevent pollution.	Two of the four deployed units reported involvement with this mission. Conducted baseline assessments and remediation efforts. Developed spill response procedures.
Construction for local country (Not in Manual)	Could incorporate any of the above missions.	Only the 673rd FED as part of the 20th Engineer Brigade reported any involvement with this mission. Worked on housing for resettled civilians.

Endnotes

[1] These descriptions of the type of missions US forces will have to execute are summarized from Chapter 2 of U.S. Department of the Army, *Operations*, Field Manual 3.0, (Washington D.C.: U.S. Department of the Army, February 2008).

[2] U.S. Joint Forces Command, *The Joint Operating Environment 2010*, (Norfolk, VA, US Joint Forces Command, February 2010), 4.

[3] Descriptions of when stability operations may be conducted are summarized from chapter 2 of U.S. Department of the Army, Stability *Operations*, Field Manual 3.07, (Washington D.C.: U.S. Department of the Army, October 2008).

[4] Ibid, 1-15.

[5] Colonel Allan L. Webster, *The Role of the Army in Infrastructure and Capacity Building*, Strategy Research Project (Carlisle Barracks, PA: U.S. Army War College, April February 9, 2010), 16.

[6] U.S. Department of the Army, *Engineer Operations – Echelons Above Brigade Combat Team*, Army Tactics, Techniques and Procedures Manual 3-34.23, (Washington D.C.: U.S. Department of the Army, July 8, 2010), 4-2.

[7] U.S. Department of the Army, *Engineer Operations*, Field Manual 3-34, (Washington D.C.: U.S. Department of the Army, April 2009), 2-8.

[8] Mr. Peter Zamarchi, 412th Theater Engineer Command, e-mail message to author, January 24, 2011.

[9] U.S. Joint Forces Command, *Engineer Doctrine for Joint Operations,* Joint Publication 3-34, (Suffolk, VA: U.S Joint Forces Command, July 5, 2000), II-12.

[10] U.S. Army Center for Army Lessons Learned, *Engineer Operations OIF Initial Impressions Report*, October 23, 2008, Executive Summary, 1.

[11] U.S. Department of the Army, *Engineer Operations – Echelons Above Brigade Combat Team*, F-2.

[12] U.S. Army TRAC Analysis Center, *Engineer Brigade Command and Control DOTMLPF Assessment Final Report (Draft)*, September 2010, 14-15.

[13] U.S. Department of the Army, *General Engineering*, Field Manual 3-34.400, (Washington D.C.: U.S. Department of the Army, December 2008), 1-2.

[14] U.S. Department of the Army, *Engineer Operations*, 3-5.

[15] U.S. Army TRAC Analysis Center, *Engineer Brigade Command and Control DOTMLPF Assessment Final Report (Draft)*, A-4.

[16] U.S. Department of the Army, *Engineer Operations*, 2-4 – 2-5

[17] Ibid, 2-3.

[18] COL Chris Martin, "FORSCOM Engineer Road to War," briefing to 411th Engineer Brigade Commander's Readiness Conference, New Windsor, NY, September 25, 2010

[19] Ideas on how specialized skills that Reserve Component personnel gain from their civilian jobs provide value to the Army is based on John Nagl and Travis Sharp's article, "Operational for What? The Future of the Guard and Reserves," *Joint Forces Quarterly*, no. 59 (4th Quarter 2010), 25.

[20] U.S. Department of the Army, *Engineer Operations*, 3-5.

[21] U.S. Department of the Army, *General Engineering*, 1-2.

[22] U.S. Army Center for Army Lessons Learned, *Engineer Operations OIF Initial Impressions Report*, October 23, 2008, 21.

[23] Webster, *The Role of the Army in Infrastructure and Capacity Building*, 14.

[24] Discussion of the difficulties in using an airport with limited runways, parking areas, lighting and navigation aids is described in "Task Force Hawk" in Bruce R. Nardulli et al, *Disjointed War* (Santa Monica, CA: RAND Arroyo Center, 2002).

[25] Webster, *The Role of the Army in Infrastructure and Capacity Building*, 3.

[26] U.S. Army Center for Army Lessons Learned, *Engineer Operations OIF Initial Impressions Report*, October 23, 2008, 38.

[27] U.S. Army TRAC Analysis Center, *Engineer Brigade Command and Control DOTMLPF Assessment Final Report (Draft)*, 2.

[28] Dr. Donald Wright and Colonel Timothy R. Reese, *On Point II: Transition to the New Campaign* (Fort Leavenworth, KS:, Combat Studies Institute Press, 2008), 372.

[29] U.S. Department of the Army, *Engineer Operations*, 2-10 – 2-11.

[30] Ibid, 2-8.

[31] U.S. Department of the Army, Modified Table of Organization and Equipment (MTOE) for HHC, THEATER ENG CMD (RECAP), April 20, 2010.

[32] MAJ Tracy A. Coleman, USAR, e-mail message to author, December 13, 2010.

[33] The effect of combat operations on the ability of engineer headquarters to concentrate on general engineering were taken from an e-mail message to the author from LTC Kurt Wagner, USAR on January 25, 2011.

[34] COL John P. Constable, USAR, e-mail message to author, December 7, 2010.

[35] Major Darick Edmond, USAR, “After Action Review for the deployment of the 673rd Facility Engineer Detachment in support of OPERATION IRAQI FREEDO 07-09,” memorandum for record, Logistics Support Area Anaconda, Balad, Iraq, May 20, 2008, 7.

[36] U.S. Department of the Army, *Engineer Operations – Echelons Above Brigade Combat Team*, F-2.

[37] 411th Engineer Brigade, “OPERATIONS ORDER 411-11-003 (Operation Dix CIRC-11),” operations order, New Windsor, NY, December 15, 2010, 1.

[38] U.S. Joint Forces Command, *Engineer Doctrine for Joint Operations*, B-A-7.

[39] Wright and Reese, *On Point II: Transition to the New Campaign*, 380.